The NYNEX study consists of some six charts depicting specific ISP multiline hunt groups, and the usage they each experience. In its cover letter to the FCC, NYNEX explains that about 200 companies use analog dial-up connections in its serving area, and that the number of lines being used in this way increases by approximately 10% each month. For the specific hunt groups it examines, NYNEX provides information about call attempts and overflow counts, as well as usage and holding times. The key problems with the NYNEX study are readily apparent:

- NYNEX, like U S West, fails to cite any specific examples of ISP-related traffic causing blocking at the level of the switch and, again like U S West, does not point to any specific investments it has made thus far that were necessitated by the growth of data traffic on its network.

- In presenting data only for selected ISPs, NYNEX provides no information about how data traffic impacts other users of its network, or the network as a whole, if indeed it does so at all.

- The NYNEX data indicate that any blocking problems that do occur are not problems at the level of the switch, but are instead associated with ISPs that have failed to provide a sufficient number of access lines for the number of customers they are attempting to serve in a given hunt group. Indeed, the charts presented by NYNEX address only calls to the specific Internet providers examined, and do not provide any information about other calls being handled by the same switch.

The charts that comprise the NYNEX study consist solely of ISP traffic patterns at selected central office switches. This study, therefore, presents no evidence that ordinary PSTN use is in any way affected by calls to ESPs/ISPs. Further, in cases where the NYNEX data show that calls to ISPs are being blocked, there is no way to distinguish between traffic creating blocking at the switch level and blocking caused simply by the limited number of lines a given ISP has configured in its multiline hunt group.

Indeed, it seems clear that the problematic switches in the NYNEX study are those where the ISP has failed to provision sufficient lines for the number of customers in the area. For example, one of the switches examined in the study, a DMS-100 DS-0 in Hempstead, had 450-660 of 500-700 call attempts blocked during its busy hours. However, given that the ISP in question had only a 22-line hunt group, it is hardly surprising that so many call attempts were blocked. That degree of blocking does not in itself indicate that the switch as a whole experienced congestion at any of those times. It simply indicates the presence of an unsatisfactory level of service from that particular ISP. Other switches studied by NYNEX, like the DMS-100 DS0 in White Plains, had high usage but no calls blocked, and it is reasonable to conclude that this is because the ISP there had an appropriate number of lines to support its average number of call attempts per hour.

NYNEX's New York Telephone Company local tariffs apply a substantial surcharge for PRI ISDN trunk-side connectivity,[86] which likely induces some ISPs to elect the less expensive line-side 1MB business line alternative. Although NYNEX demonstrated no switch congestion problems in its study, it would certainly eliminate any such problems that might arise by applying appropriate cost-based pricing for ISP access, and by not engaging in pricing practices that suppress and discourage efficient ISP serving arrangements.

Finally, based upon the NYNEX data for second line growth summarized in Chapter 3, Internet and on-line service traffic should properly be considered a source of significant amounts of revenue for the company. Indeed, the 1.26-million second residential lines reported by NYNEX in 1995[87] translate into $33.3-million in revenues for that year.[88] And given that the corresponding revenue figure for 1994 was approximately $28.9-million,[89] the second line revenue stream is growing at 9.3% annually.

Bell Atlantic

Of all the BOCs, Bell Atlantic's study provided the greatest depth of analysis of the data that it collected on ESP usage. However, Bell Atlantic makes many of the same misleading assumptions and conclusions as the other studies. Among them are these:

- Bell Atlantic notes that a large fraction of ESPs (roughly 50%) in its territory connect to its central offices via PRI ISDN using trunk port connectivity and hence bypassing the Line Concentration Module (LCM). However, it does not point out that PRI ISDN is inherently non-blocking at the terminating switch, and that therefore the use of this arrangement all but eliminates data traffic congestion in such switches.

- In calculating the revenues it derives from data traffic on its network, Bell Atlantic ignores the fact that local calls are *sent paid*. Many Bell Atlantic business lines are provided on a measured-rate basis, so the Company receives duration-based

86. *See* Table 1.

87. NYNEX, *1995 Profile & Statistics*, *op. cit.* footnote 49, *supra*, at 33.

88. Based upon an weighted-average rate in New York state for unlimited local residential service of $26.45, including touch tone charge, SLC, surcharges, and taxes. *See*, FCC Industry Analysis Division, Common Carrier Bureau, *Reference Book: Rates, Price Indexes, and Household Expenditures for Telephone Service*, July, 1994, Appendix 2: Residential Telephone Rates by City, October, 1993. Note that this figure is calculated exclusive of installation charges for those lines.

89. Based upon the $25.10 rate cited in the previous footnote, and 1.150-million access lines in 1994 (NYNEX, *1995 Profile & Statistics, op. cit.* footnote 49, *supra*, at 33).

revenues from calls to ISPs placed over those lines. Moreover, for reasons discussed previously, the presence of flat-rate pricing of the calling party's line in no sense makes such calls free. Rather the flat-rate incorporates a usage component that will on average cover the company's usage-related costs.

- Bell Atlantic further ignores other sources of revenues, including the substantial amount of revenues it derives from second lines, revenues from residential and business customers who purchase ISDN connections, and revenues from ISPs that purchase additional features (direct inward dialing services, for instance) that are tariffed separately from basic business analog or ISDN rates.

According to the Bell Atlantic study, of the 4,887 ISP circuits it examined, fully half used PRI connections, with the remaining half using standard analog business line-side connections.[90] Bell Atlantic subsequently stated that the fifty percent figure was representative for all ESP/ISPs it serves.[91] This means that fully half of the ISP lines in Bell Atlantic's serving territory are non-blocking at the terminating end office switch, a fact that Bell Atlantic does not mention in its study. For instance, in its discussion of elements of the network, Bell Atlantic states that "if all lines are at the 25-30 CCS level, then the LU (line unit) can accommodate only about 65 subscriber lines."[92] Nowhere does it make clear that PRI ISDN bypasses the line unit, and that as a result the 65-line limitation does not occur for ISPs using that technology. Since Bell Atlantic has implemented rates for its PRI ISDN service only slightly higher than for basic business service, there is reason to conclude that most, if not all, ISP growth in Bell Atlantic's territory will similarly be ISDN, thus eliminating the possibility of blocking at the central office switch that terminates calls to the ISP.

One of the conclusions of the Bell Atlantic study is that traffic levels for ISPs are "significantly above normal customer traffic levels."[93] In this context, the definition of the word "normal" is ambiguous. "Normal" could mean the average for the network as a whole. In that case, it is not a particularly fair comparison, since by definition ISPs are large-volume call recipients. The correct comparison — and one that Bell Atlantic does not offer — is that between ISPs and PBX trunks in groups of comparable size, as this study developed in Chapter 2. There is no reason to expect that ISP traffic will be any higher than that of other comparable large end users.

90. Bell Atlantic study, at 5.

91. *Id.*, at 15.

92. *Id.*, at 8.

93. *Id.*, at 7.

The Bell Atlantic study significantly understates the revenues it derives from data traffic by ignoring entirely the substantial revenues that the company derives from customers of ISPs who purchase second lines, incur measured or flat-rate local usage charges, or upgrade to ISDN. In calculating revenues from ISPs, the Bell Atlantic study estimates revenue per ISP line at $17.00 per month.[94] This results in an estimated total revenue for PSTN service of approximately $8.2-million in 1996.[95] However, Bell Atlantic, like Pacific Bell, has reported extremely strong earnings growth figures, which it attributes in large part to the growth in demand for second residential access lines. Indeed, Bell Atlantic's CEO, Raymond F. Smith, recently stated that the rate of additional line growth in his territory is increasing, and that additional lines produce significant incremental revenue. In a March 19, 1996, speech to a group of securities analysts at a Merrill Lynch Telecommunications CEO Conference, Smith said:

> In 1995, sales of secondary lines at Bell Atlantic increased more than 50 percent, fueled by surging demand for Internet and telecommuting applications.
>
> Unlike traditional horizontal line growth, which would have significantly added to our capital expenditures, the vertical growth we experienced in '95 brought most of the revenues down to the bottom line. *That's because we were able to provision new lines and services from idle capacity in an existing plant.*[96]

Finally, the Bell Atlantic study draws a comparison between ISPs and IXCs in its conclusion, which merits comment. Bell Atlantic calculates that, in contrast with its interstate switched access charge (the charge IXCs pay) of $0.02 per minute, ISPs pay only $0.0009 per minute of use. As the discussion of additional BOC revenues has shown, the actual amounts that should be attributed to on-line service usage of the PSTN are potentially significantly higher. That aside, the relevant comparison is not with the uneconomic level of rates that Bell Atlantic and other ILECs impose upon IXCs. Rather it is with the forward-looking incremental *cost* of the service that is supplied to ISPs.

Bellcore

94. *Id.*, at 15.

95. *Id.*, at 13.

96. Raymond F. Smith, speech delivered at Merrill Lynch Telecommunications CEO Conference, March 19, 1996 (emphasis added).

A final piece of evidence to which the BOCs and BOC representatives refer in making their case for Internet access charges is a study prepared by Bellcore on data traffic and the PSTN.[97] The Bellcore study provides both a description of the alleged costs that are presently being imposed upon the LECs by data traffic, and also offers a more long-term view of technologies that would migrate that traffic, in part or entirely, away from the PSTN. One of the key conclusions reached by Bellcore is that, due to the inefficiency with which the circuit-switched voice network handles data calls, "any long term solution necessarily involves a staged migration from the present mode of operation towards some packet network solution."[98] While the Bellcore study arrives at the correct *long term* conclusion, there are flaws in its assessment of the immediate problems that data traffic poses to the PSTN. Among these flaws are:

- In assessing network costs of on-line service use, the Bellcore study, like the BOC studies, discounts the substantial revenues that data traffic currently generates.

- The theoretical analysis presented in the Bellcore study is very detailed; however, it provides little in the way of evidence regarding the applicability of its assumptions in the actual BOC networks.

- The Bellcore study reaches the appropriate conclusion regarding the long-term migration of data traffic to a network based on a technology more appropriate than the PSTN; however, with the exception of cable modems as an option, it does not consider the likelihood of competitive entrants to provide data networks faster and more cost-effectively than the BOCs.

Like the individual BOC studies, Bellcore fails to consider the substantial revenues that the ILECs currently derive from the growth of Internet and other on-line services. According to Bellcore, the growth of on-line services has increased the load on ILEC networks while providing "very little compensating revenue."[99] It claims, for example, that second line revenues are "unlikely to offset capital expenditure,"[100] without providing any justification for that assertion. Such a notion is, of course, at odds with recent earnings reports and other statements by a number of the BOCs, which expressly associate significant

97. Amir Atai, Ph.D. and James Gordon, Ph.D., "Impacts of Internet Traffic on LEC Networks and Switching Systems," Red Bank, New Jersey, Bell Communications Research, Inc., 1996.

98. *Id.*, at 1.

99. *Id.*, at 2.

100. *Id.*, at 4.

earnings growth with second line demand and the ability of the BOCs to meet that demand using *existing* capacity.[101]

Another important flaw in the Bellcore study is its inherently theoretical approach. Bellcore develops a mathematical model to estimate the cost impact of reinforcing the circuit-switched network, and argues that given the growth of data traffic "solutions need to be put in place quickly in order to protect the integrity of the PSTN."[102] However, Bellcore does not provide any evidence or quantification of congestion problems that might be occurring in the real world. The theory presented in the Bellcore Study provides little evidence that the problems it describes are actually problems the ILECs currently face. The traffic properties associated with long-duration calls as described by Bellcore become important only when such calls represent a significant portion of total traffic at any given network service point. While this can occur in a central office that serves an ISP/ESP and in which the ISP/ESP traffic has not been properly balanced with other traffic, the *de minimis* fraction of total network usage represented by such long-duration calls reduces the applicability of Bellcore's analysis.

Finally, the Bellcore study maintains the implicit BOC assumption that the Internet access problem will only be solved by the BOCs acting to reinforce the BOC networks (albeit with more appropriate technologies than some of the BOCs themselves seem to suggest). With the exception of cable modems, which Bellcore does mention as a potential solution, there is no discussion of the possibility that other non-ILEC providers might create a data-friendly, packet-switched network independent of the existing PSTN. This is likely to occur, however, if the BOCs are required by regulators to facilitate such competition through expanded co-location and unbundling (including subloop unbundling). It is highly probable that this sort of competition will prove essential to the creation and growth of a data-friendly network (or networks) capable of providing service at prices far more affordable than those the BOCs have been willing to implement.

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101. On October 18, 1996, the *Wall Street Journal* reported that demand for second phone lines played a significant role in the strong third-quarter profits of Bell Atlantic, BellSouth, Pacific Telesis, and SBC, noting these companies' reports of year-over-year access line growth of 3.7%, 4.9%, 4.4%, and 5.2%, respectively, with average line growth reported at 4.7%.

- Since January, BellSouth reported activating 203,000 new additional residential lines, an annual growth rate exceeding 23%, bringing total additional residence lines to 1.5-million. (BellSouth Press Release, October 17, 1996.)

- Bell Atlantic reported that "continued growth in home computer use propelled gross sales of secondary residential telephone lines to nearly 233,000 in the third quarter, more than 60 percent above year-earlier levels." (Bell Atlantic Press Release, October 17, 1996)

See also the Raymond F. Smith, speech, *op. cit.* at footnote 96, *supra.*

102. Bellcore study, at 2.

Bellcore astutely points out that packet-switched networks, which constitute a far more appropriate means of transmission of data traffic than the PSTN, exist today, but that "due to cost and equipment limitations, access to these networks is largely limited to high volume business users."[103] The pricing of data network access such that residential users could afford it could well lead to a migration of data traffic off the PSTN before congestion causes more than isolated problems there.

From the ISP perspective, Bellcore concludes that "the competitive cost of basic line side connections is undoubtedly attractive to ISPs. However, line side connections are more expensive [for ISPs] to maintain operationally, and as multiline hunt group sizes grow, there may be some cost incentive for ISPs to move towards trunk or PRI interfaces."[104] Such a shift by ISPs to trunk port connections will do much to reduce the instances of blocking at the end office switch. Indeed, virtually all of the potential switching problems cited by the Bellcore study are eliminated by trunk-side connectivity.

103. *Id.*, at 1.

104. *Id.*, at 6.

5 | CONCLUSION

The BOC studies present an inaccurate picture of the effect of data traffic on their networks, overstating the costs and congestion, while understating the revenues generated. They do not justify the imposition of access charges upon ESPs and ISPs.

As the preceding sections have demonstrated, the BOC studies present an inaccurate and incomplete assessment of data traffic on local telephone networks. The BOC studies must be recognized for what they are: a collection of anecdotal evidence about a limited number of central office switches, from which the incorrect conclusion is drawn that data traffic presents a serious problem for the PSTN as a whole. This analysis has demonstrated conclusively that the BOC studies do not justify the imposition of access charges on Internet and other enhanced service providers.

Examining the design of the local telephone network and of a typical Class 5 switch, as this Study did in Section 2, reveals where congestion potentially can occur in the public switched network. Any congestion or other problems in the Internet itself, or in a particular ISP's network configuration, pose no cause for concern by the BOCs, since these problems do not significantly affect users of the PSTN. Far from having their entire networks threatened by data traffic overload, congestion and blocking is likely to occur at only a few distinct points in the network, primarily end offices that serve large ESPs, and possibly the particular interoffice trunks that serve those end offices. Indeed, the BOC studies themselves report switching problems that are entirely confined to the end offices that serve ESPs/ISPs. This Study has demonstrated that alternatives that route data traffic around the line concentration module (LCM) (or the Line Unit (LU) in the Lucent 5ESS switch), the only switch component at which blocking *may* occur, are routinely and easily configured.

In their studies, the BOCs significantly overstate the costs they incur as a result of data traffic. Data traffic has caused only a small number of problems that have required the BOCs to add or upgrade central office equipment. And it is impossible to say based on the BOC studies how many of those central office upgrades would have been undertaken even if no data traffic passed over the PSTN at all. Although the BOCs advocate a per-minute access charge as a way to cover the purportedly *higher* costs imposed by ESP traffic on

their networks, this Study presented an analysis that demonstrates that data traffic does not impose disproportionate costs when compared to voice traffic. In fact, increased data traffic is likely to result in *lower* overall per-minute costs for the ILECs, by making efficient use of idle network capacity.

Moreover, none of the BOC studies provide a complete accounting of the revenue streams that data traffic generates. From second line sales to ISDN, ESP/ISP traffic is generating demand for a variety of products and services that the BOCs profitably provide. Indeed, the BOCs have an excellent market opportunity to meet their customers' growing need for cost-efficient, high-bandwidth data networks. Investment in such data-friendly technologies, by the BOCs or their competitors, would also remove data traffic from the voice PSTN entirely, thus eliminating even the small potential for congestion that presently exists in certain elements of the network. The imposition of access charges is unnecessary, since the BOCs are already fully compensated for data traffic, and such charges would impede the ability of consumers to benefit from on-line services.

The long term solution for accommodating increased data traffic on local ILEC networks lies in the stimulation of competition and in the deployment of appropriate *data-friendly* transmission technologies, and *not* in the imposition of access charges for use of the circuit-switched PSTN.

While it should be apparent that the growth of the Internet and other on-line services does not present any serious congestion or revenue problem for the existing ILEC networks, the requirement that ISPs and their users continue to rely upon the circuit-switched PSTN to connect to one another does present formidable technical impediments to the continued growth and development of these new technologies.

Dial-up calls placed over the PSTN require that whatever is transmitted thereon somehow fit within the bandwidth of a voice conversation. Remarkable advances in modem technology have pushed the envelope far beyond anyone's expectations as recently as ten years ago, but the laws of physics and mathematics will soon work to limit further data rate gains. The current maximum voice-grade dial-up data rate is 57.6 kbps, the recently announced "X-2" technology by US Robotics.[105] With compression, even higher effective rates would be achievable at the 57.6 kbps base rate. However, with the proliferation of graphics, animation, video and other high-bandwidth applications, even these higher data rates will prove inadequate.

105. "U.S. Robotics Releases Preliminary Performance Data on its High-Speed X2 Modem Technology," Press Release. Downloaded from U.S. Robotics home page, http://x2.usr.com/news/betatest.html, January 9, 1997.

The existing ILEC subscriber distribution plant is capable of supporting significantly higher data transmission rates; the limitation here is the continued reliance upon *circuit-switching* rather than one of the various *packet-switching* protocols for the transmission of data. These alternative network technologies are available today, but have not been deployed on a mass scale by the ILECs. Competing local carriers could speed this deployment *if they were provided access to individual outside plant loop components currently under the exclusive control of the incumbent LECs.*

While the focus of this report has been the use by on-line services of the existing circuit-switched public network, continued reliance on the PSTN is not a satisfactory solution to the needs of ISPs, ESPs and their customers. The future of ISP/ESP communications lies in the development of alternative, data-friendly networks that possess the capacity to route packetized data traffic at high speeds. The development of a competitive marketplace at the level of the local exchange will ensure that the demand for such networks is met as quickly and efficiently as possible.

Appendix A

Second Lines Attributable to On-Line Service Use — ETI Analysis

Revenues Derived from Installation of Additional Residental Access Lines Attributable Primarily to Internet Use

(L) Year	(M = H) Lines Dedicated to On-Line Use	(N =CHANGE IN M) Internet Lines Installed In Year	(O = 33% of M) "Churn" (Lines Disconnected and Re-Installed)	(P = N + O) Total Installed Lines For On Line Use	(Q) Installation Charges	(R = Q X P) Total Revenues From Installation
1990	0	0	0	0	43.06	$0
1991	1,311,024	1,311,024	437,008	1,748,032	42.00	$73,417,340
1992	2,174,846	863,822	724,949	1,588,770	41.52	$65,965,749
1993	2,385,085	210,239	795,028	1,005,267	41.38	$41,597,961
1994	3,697,561	1,312,476	1,232,520	2,544,996	41.00	$104,344,852
1995	6,043,721	2,346,160	2,014,574	4,360,734	40.91	$178,397,610
					Total Installation	**$463,723,513**
				Total Revenues Derived from On-Line Service Use		**$3,635,037,424**

Notes: Lines Dedicated to On-Line Use is based on the analysis presented on the previous page.
Churn (Column O, above) refers to the number of access lines disconnected and reinstalled in a given year.
Total Revenues Derived from On-Line Service Use refers to both recurring revenues and installation charges.
Source for Installation Charges: FCC, Monitoring Report, 1996.